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(54) DEVICE AND METHOD FOR APPLYING CLOSURES TO FLEXIBLE CONTAINERS AND THE LIKE

(71) We, IMPERIAL CHEMICAL INDUSTRIES LIMITED of Imperial Chemical House, Millbank, London, S.W.1., a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a device and method for applying closures to flexible containers and the like, more particularly for applying ligatures to bunched necks or bags, packages, tubing, tubular containers or other articles formed of plastics films or other flexible sheet materials.

A closure device commonly used for flexible containers in the packaging industry is a ligature of wire or other pliable material applied to the bunched neck of a package. For example, such closures are often used to close the necks of bags, or to close the ends of sausage-like containers formed in continuous lengths, stuffed with meat or other foods.

It is sometimes necessary that such ligatured closures should be capable of resisting considerable pressures, such, for example, as for those developed when pasty substances are stuffed under pressure into the containers, or when the container is for liquid or other products to be packed under superatmospheric pressure. To withstand such pressures, relatively thick wire ligatures or strong metal clips have been used, but these have been found to be unduly expensive. The alternative of winding a ligature of thinner wire more than once round the bunched neck before twisting or tying its ends has not been easily accomplished as a commercial operation, particularly in processes that require ligatures to be applied at intervals along a continuous length of tubing.

It is therefore an object of the present invention to provide a device and method by which ligatures wound more than once

round the bunched necks may be more easily applied.

In accordance with the present invention, a device for placing a ligature upon a bunched neck of a tube, wrapper or other article of flexible material, and including a slot for receiving the bunched neck, is characterized in that the slot is provided by a rotatably mounted slotted member, the slot of said member being a radial slot extending inwardly to beyond the axis of rotation so that the bunch may be passed along the slot to lie with its longitudinal axis substantially coinciding with the axis of rotation of the member, and in that locating means are provided on said member adjacent said slot and rearward of the direction of rotation of said member to receive an end of a length of ligaturing material which passes around the bunched neck and is held against movement with the first end at its other end, and to hold the first-mentioned end for rotation with the member to wind it around the bunched neck.

The said other end of the length of ligaturing material is supported sufficiently to hold it against rotation with the rotatably mounted slotted member. It may be held by means provided in the device itself, or by external means, for example by a reel for supplying the ligaturing material, from which the length may be cut after the winding operation.

The invention further provides a method of ligaturing a bunched neck of a tube, wrapper or other article of flexible sheet material, that comprises winding a ligature around the bunched neck by means of the device of the invention as hereinbefore described, to encircle the neck by the ligature.

In one embodiment of the invention, the device is adapted for use in a known method in which ligatures are applied by bunching the neck to be ligatured, placing a length of the ligaturing material transversely against the bunched neck, and inserting the bunched neck, with the ligature in advance, into a slot at

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right angles to the longitudinal axis of the bunch and substantially U-shaped in cross-section, so that the ligature is bent to U-shaped form as it is drawn past the edges of the slot. In this known method, the ends of the ligature are subsequently twisted or tied together.

In this particular embodiment of the invention, the device includes a pair of co-operating slotted members each having a flat face opposed so that of the other member, the members being rotatable relative to one another about an axis perpendicular to said flat faces, the slot of each member being a radial slot extending inwardly to beyond the axis of relative rotation and the slots of the two members forming, at a certain phase of rotation, a continuous slot for receiving the bunched neck together with the length of ligaturing material so that the bunch may be brought to lie with its longitudinal axis substantially coinciding with the axis of relative rotation of the members, each member having, on that wall of its slot which is rearward in the direction of rotation of that member relative to the other member, a means for locating one arm of the length of ligaturing material upon said wall when this length has been urged by the walls of the slot to substantially U-shaped form, means being provided for rotating at least one of said members through at least one full circle relative to the other said member.

In this device the means for locating an arm of the length of ligaturing material upon the rearward wall of the slot is preferably a groove running along this wall, such that the opposite arms of the ligaturing material may be progressively drawn into the grooves of the two members as the material is urged into substantially U-shaped form.

One preferred form of this embodiment of the invention will now be more particularly described by way of example with reference to the drawings accompanying the provisional specification, which show a double ligaturing device, comprising a rotor co-operating with two stators, for applying two ligatures to a bunched neck of a length of tubing; this, for example, it may be used for applying ligatures to the trailing end of one tubular container, and simultaneously to the leading end of the next. In this device, each rotor/stator unit functions as a ligaturing device in the manner hereinbefore described.

In the drawings:

Figures 1 to 5 show diagrammatically the action of one rotor/stator unit, the flat face of the stator being shown in plan view, and the adjacent rotor being indicated by dotted lines;

Figure 6 is a perspective view of a device, comprising two stators and one rotor, shown with one stator separated from the rotor; and

Figure 7 is a diagrammatic end view of a suitable drive for the device.

In Figures 1 to 5: 1 is the flat face of a stator, and 2 the adjacent flat face of a rotor. The stator and rotor are provided with U-shaped radial slots, 3 and 4 respectively, each extending inwardly to beyond the axis of rotation of the rotor. The slot 3 is provided with a groove 5, and the slot 4 with a groove 6, each on that wall of the slot which is rearwards in the direction of relative rotation. The rotor is shouldered at 7, and is held within a housing, 8, which is bolted to the stator and which is bored to receive rotatably the end of the rotor, and also has a circular recess, 9, provided for a purpose which will become apparent hereinafter. The bunched neck to be ligatured is indicated at 10, and the length of ligaturing material at 11. Figure 1 shows the ligaturing material 11 lying between the bunched neck and the slots 3, 4. In Figure 2 is shown the position of the bunched neck and ligature after the neck has been brought against the ligature and into the slots 3, 4, the ligature having been drawn into the slot and urged into U-shaped form, one arm, 12, having been received into the groove 5, and the other, 13, into the groove 6. The bunched neck now lies with its longitudinal axis coinciding with the axis of rotation of the rotor. Figure 3 shows the device with the rotor in motion; the arm 12 of the ligature is held stationary, while the arm 13 is being carried round, the recess 9 in the housing 8 providing a free passage for its projecting end. Figure 4 shows the device after one complete turn of the rotor, the ligature having been passed once round the neck (giving, in all, two turns of the ligature round the neck), and at this stage the slots are again continuous with each other and the bunch with its encircling ligature may be removed. Alternatively, the ligature may be wound one or more further turns round the neck. Finally, the ends of the ligature, after removal of the bunch from the slot, may if desired be twisted or tied together.

In Figure 6, reference numbers 1 to 9 indicate the same parts as in Figures 1 to 5. 1a and 8a, respectively, indicate the stator and the rotor housing of the second ligaturing unit of the device; the corresponding end of the double rotor unit is constructed as a mirror image of the end shown in Figure 6. The first stator and the rotor housing 8 are shown removed from the rotor; the housing 8 when in position abuts against the shoulder, 7, of the rotor. The stator and rotor housing units are drilled, as at 14, for attachment by screws, from each end of the device, to four spacer units (not shown) which hold the rotor housing units with a clearance from the shoulders, 8, of the rotor sufficient for the rotor to be freely rotatable.

In Figure 7 is shown the double rotor

with a flat face at 2 and with its U-shaped radial slot, 4, and the bunched neck, 10, of the tubing. The rotor is provided with gear teeth, 15, which engage with the teeth of a pair of gear wheels, 16a, 16b, both driven by a gear wheel, 16, which in turn is driven by a rack, 17.

In use of the device just described, a length of the ligaturing material, 11, 11a, is provided at each end of the bunched neck, each being opposite the interface between the corresponding rotor/stator units, and each, as the bunched neck is being pushed into the slot, having its end received by the grooves in the rotor/stator slots. The lengths of ligaturing material are held at an angle to the rotor/stator interface such that the arms of the ligatures are guided into the grooves.

Various modifications may be made in the device just described. For example, it may comprise a double stator and two rotors, instead of a double rotor and two stators as shown in Figure 6; or the device may be constructed so as to provide only one ligaturing unit. Other possible constructions of the rotor/stator device include those in which both the stator and rotor are rotatable, in opposite directions. Alternative means for driving the rotor may be provided; for example, a friction drive may be used.

In an example of another embodiment of the invention, the device comprises a single slotted, rotatably mounted member for receiving the bunched neck, this member being provided on one face, against the rearward side of the slot, with a hook, eye or like locating means for taking up one end of a length of ligaturing material. The latter may be received, for example, from a supply reel of the material, the material passing to the hook or other locating means rearwardly of the bunched neck in respect of the direction of rotation of the member. In operation of the device, the end of the ligaturing material, having been received by the locating means during a stationary phase of the member, is wound round the bunched neck on rotation of the member, while the other end is held in position by the reel (and is preferably held against further withdrawal from the reel) or by other means. When the leading end has been wound the required number of turns round the neck, rotation is stopped, the ligaturing material is severed from the supply reel (if still attached), and the bunch is removed from the slot. The ends of the ligature may if desired be twisted or tied together before or after the removal of the bunch from the slot.

This device may be adapted for use as a double ligaturing device, similar to the device previously described with reference to Figure 6, by the provision of a locating means for an end of the ligaturing material on both faces of the device, and by feeding a supply

of material to each. Frequently, the double unit device of either type is particularly useful. For example, plastics film containers requiring a closure capable of resisting high pressures may be formed continuously before filling, from a continuous length of plastics tubular film, and subsequently filled through apertures in the container walls; or they may be closed during filling by a stuffing method. In each case it is desirable to ligature the adjacent ends of adjacent containers simultaneously. However, single ligaturing units are useful, for example, for closing the mouths of filled bags, sacks, or other packages, particularly when an especially strong closure is required.

The device of the invention may be used whenever it is desired to twist a ligature at least twice round a bunched neck. It will be appreciated that the second turn of the ligature need not be completed by the device itself, provided that the two ends are left sufficiently close together to be taken up by a means for twisting or tying them together, this latter means thus completing the second turn of the ligature upon the neck. Although the ends of the ligatures are usually tied or twisted together, and this is generally necessary for high pressure resistance, it may in some instances be preferred to wind the ligature round the neck a sufficient number of turns for further fastening to be unnecessary.

WHAT WE CLAIM IS:—

1. A device for placing a ligature upon a bunched neck of a tube, wrapper or other article of flexible material, and including a slot for receiving the bunched neck, characterized in that the slot is provided by a rotatably mounted slotted member, the slot of said member being a radial slot extending inwardly to beyond the axis of rotation so that the bunch may be passed along the slot to lie with its longitudinal axis substantially coinciding with the axis of rotation of the member, and in that locating means are provided on said member adjacent said slot and rearward of the direction of rotation of said member to receive an end of a length of ligaturing material which passes around the bunched neck and is held against movement with the first end at its other end, and to hold said first-mentioned end for rotation with the member to wind it around the bunched neck.

2. A device as claimed in Claim 1 that includes a pair of co-operating slotted members each having a flat face opposed so that of the other member, the members being rotatable relative to one another about an axis perpendicular to said flat faces, the slot of each member being a radial slot extending inwardly to beyond the axis of relative rotation and the slots of the two members forming, at a certain phase of rotation, a continuous slot for receiving the bunched neck together

with the length of ligaturing material so that the bunch may be brought to lie with its longitudinal axis substantially coinciding with the axis of relative rotation of the members, each member having, on that wall of its slot which is rearward in the direction of rotation of that member relative to the other member, a means for locating one arm of the length of ligaturing material upon said wall when this length has been urged by the walls of the slot to substantially U-shaped form, means being provided for rotating at least one of said member through at least one full circle relative to the other said member.

3. A device as claimed in Claim 2 in which the means for locating an arm of the length of ligaturing material upon the rearward wall of the slot is a groove running along this wall, such that the opposite arms of the ligaturing material may be progressively drawn into the grooves of the two members as the material is urged into substantially U-shaped form.

4. A device as claimed in Claim 2 or Claim 3, for placing a pair of ligatures upon the bunched neck, that includes a rotor and two stators, the rotor having two parallel flat faces each opposed to that of one of the stators, the rotor thus providing with each stator one said pair of co-operating slotted members.

5. A ligaturing device substantially as hereinbefore described with reference to the drawings accompanying the Provisional Specification.

6. A method of ligaturing a bunched neck of a tube, wrapper or other article of flexible sheet material that comprises winding a ligature around the bunched neck by means of a device as claimed in any one of the preceding claims, to encircle the neck by the ligature.

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PROVISIONAL SPECIFICATION

4 SHEETS

This drawing is a reproduction of
the Original on a reduced scale
Sheet 2

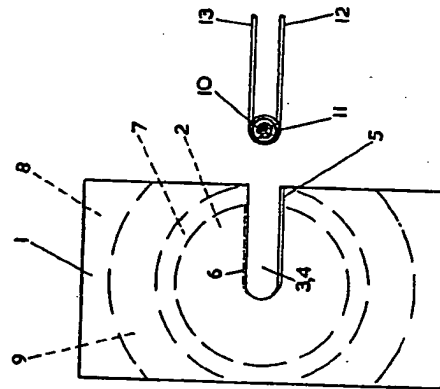


FIG. 5

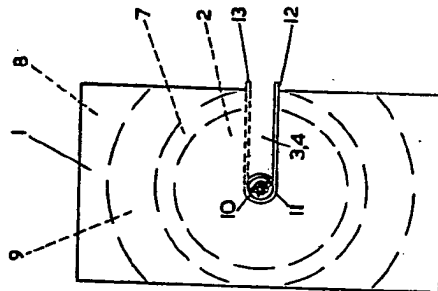
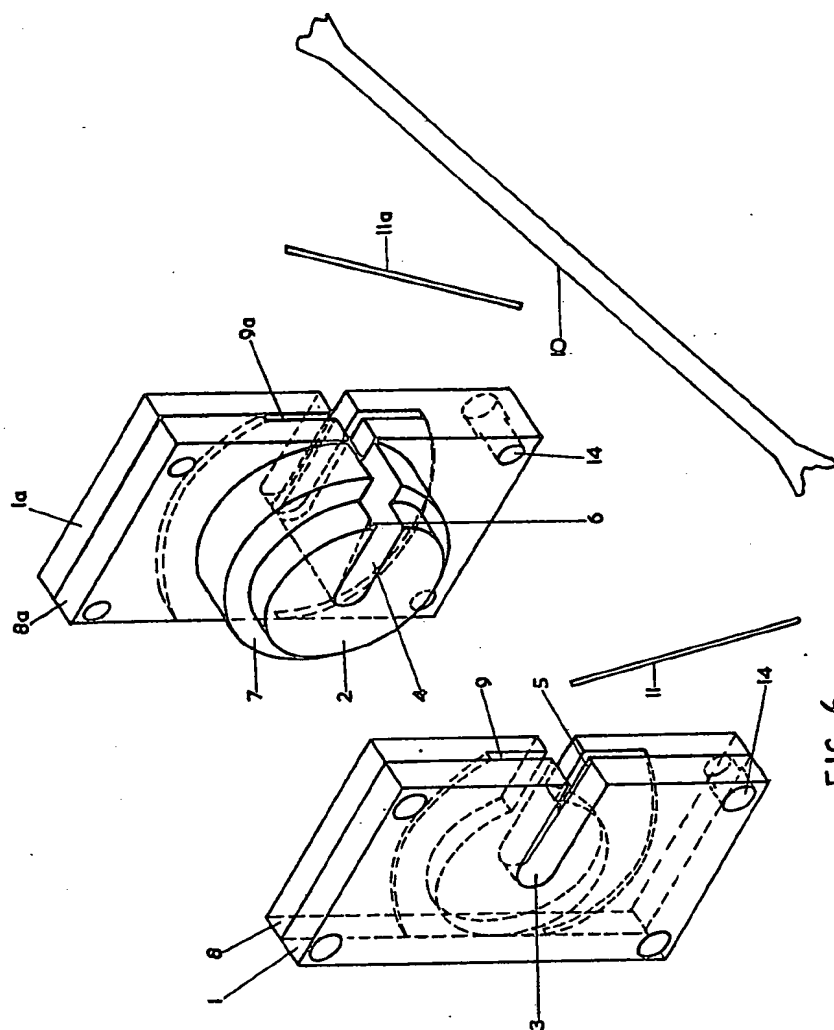


FIG. 4



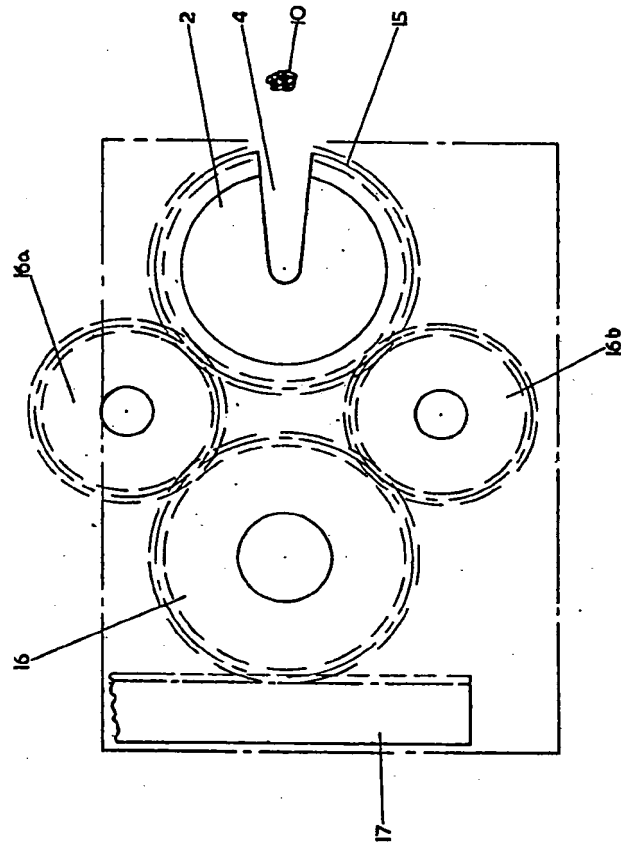


FIG. 7